

WHAT IS CLAIMED IS:

1. A hydrocarbonaceous fuel additive for a fuel composition comprising:  
a transition metal-containing compound;  
an alkali metal compound; and  
a magnesium-containing compound.
2. A hydrocarbonaceous fuel additive as described in claim 1, wherein  
the transition metal-containing compound, alkali metal compound, and  
magnesium-containing compound are included in the additive in a ratio of  
about one part transition metal, one part alkali metal, and three parts  
magnesium of the respective metals.
3. The hydrocarbonaceous fuel additive as described in claim 1,  
wherein the transition metal-containing compound is an organometallic  
compound.
4. The hydrocarbonaceous fuel additive as described in claim 3, wherein  
the organometallic compound is a compound with stabilizing ligands  
containing a functional group selected from the group consisting of alcohols,  
aldehydes, ketones, esters, anhydrides, sulfonates, phosphonates, chelates,  
phenates, crown ethers, naphthenates, carboxylic acids, amides, acetyl  
acetonates and mixtures thereof.

5. The hydrocarbonaceous fuel additive described in claim 3, wherein the organometallic compound comprises manganese.

6. The hydrocarbonaceous fuel additive described in claim 5, wherein the manganese-containing compound is selected from the following group: cyclopentadienyl manganese tricarbonyl, methylcyclopentadienyl manganese tricarbonyl, dimethylcyclopentadienyl manganese tricarbonyl, trimethylcyclopentadienyl manganese tricarbonyl, tetramethylcyclopentadienyl manganese tricarbonyl, pentamethylcyclopentadienyl manganese tricarbonyl, ethylcyclopentadienyl manganese tricarbonyl, diethylcyclopentadienyl manganese tricarbonyl, propylcyclopentadienyl manganese tricarbonyl, isopropylcyclopentadienyl manganese tricarbonyl, tert-butylcyclopentadienyl manganese tricarbonyl, octylcyclopentadienyl manganese tricarbonyl, dodecylcyclopentadienyl manganese tricarbonyl, ethylmethylcyclopentadienyl manganese tricarbonyl, indenyl manganese tricarbonyl, and the like, including mixtures of two or more such compounds.

7. A hydrocarbonaceous fuel additive as described in claim 1, wherein the alkali metal compound contains at least one alkali metal selected from the group consisting of lithium, sodium, potassium and rubidium.

8. A hydrocarbonaceous fuel additive as described in claim 1, wherein the magnesium-containing compound is selected from the group of compounds derived from sulfonic acids, carboxylic acids, alkylphenols, sulfurized alkylphenols, and organic phosphorus acids, and mixtures thereof.

9. A hydrocarbonaceous fuel additive as described in claim 1, wherein the amount of transition metal-containing compound is an amount sufficient to supply about 0.1 to 40 ppm manganese metal to the fuel composition.

10. A hydrocarbonaceous fuel additive as described in claim 1, wherein the amount of alkali metal compound is an amount sufficient to supply about 0.1 to 40 ppm alkali metal to the fuel composition.

11. A hydrocarbonaceous fuel additive as described in claim 1, wherein the amount of magnesium-containing compound is an amount sufficient to supply about 0.3 to 500 ppm magnesium metal to the fuel composition.

12. A fuel composition which comprises a major amount of hydrocarbonaceous fuel and minor amount of an additive, the additive comprising:

a transition metal-containing compound;

at least one alkali metal compound; and

a magnesium-containing compound.

13. A fuel composition as described in claim 12, wherein the transition metal-containing compound, alkali metal compound, and magnesium-containing compound are included in the additive in a ratio of about one part transition metal, one part alkali metal, and three parts magnesium of the respective metals.

14. A fuel composition as described in claim 13, wherein the transition metal-containing compound is an organometallic compound.

15. A fuel composition as described in claim 14, wherein the organometallic compound is a compound with a stabilizing ligand containing a functional group selected from the group consisting of alcohols, aldehydes, ketones, esters, anhydrides, sulfonates, phosphonates, chelates, phenates, crown ethers, naphthenates, carboxylic acids, amides, acetyl acetonates and mixtures thereof.

16. A fuel composition as described in claim 14, wherein the organometallic compound comprises manganese.

17. A fuel composition as described in claim 16, wherein the manganese-containing compound is selected from the following group: cyclopentadienyl manganese tricarbonyl, methylcyclopentadienyl manganese tricarbonyl, dimethylcyclopentadienyl manganese tricarbonyl, trimethylcyclopentadienyl manganese tricarbonyl, tetramethylcyclopentadienyl manganese tricarbonyl, pentamethylcyclopentadienyl manganese tricarbonyl, ethylcyclopentadienyl manganese tricarbonyl, diethylcyclopentadienyl manganese tricarbonyl, propylcyclopentadienyl manganese tricarbonyl, isopropylcyclopentadienyl manganese tricarbonyl, tert-butylcyclopentadienyl manganese tricarbonyl, octylcyclopentadienyl manganese tricarbonyl, dodecylcyclopentadienyl manganese tricarbonyl, ethylmethylcyclopentadienyl manganese tricarbonyl, indenyl manganese tricarbonyl, and the like, including mixtures of two or more such compounds.

18. A fuel composition as described in claim 12, wherein the alkali metal compound contains at least one alkali metal selected from the group consisting of lithium, sodium, potassium and rubidium.

19. A fuel composition as described in claim 12, wherein the magnesium-containing compound is selected from the group of compounds derived from sulfonic acids, carboxylic acids, alkylphenols, sulfurized alkylphenols, and organic phosphorus acids, and mixtures thereof.

20. A fuel composition as described in claim 12, wherein the amount of transition metal-containing compound is an amount sufficient to supply about 0.1 to 20 ppm manganese metal to the fuel composition.

21. A fuel composition as described in claim 12, wherein the amount of alkali metal is an amount sufficient to supply about 0.1 to 20 ppm alkali metal to the fuel composition.

22. A fuel composition additive as described in claim 12, wherein the amount of magnesium-containing is an amount sufficient to supply about 0.3 to 60 ppm magnesium metal to the fuel composition.

23. A fuel composition as described in claim 12, wherein the hydrocarbonaceous fuel is selected from the group consisting of No. 5 and No. 6 fuel oils, diesel fuel, jet fuel, alcohols, ethers, kerosene, low sulfur fuels, synthetic fuels, liquid petroleum gas, fuels derived from coal, coal, coal dust, coal slurry, biofuels, natural gas, propane, butane, unleaded motor and aviation gasolines, reformulated gasolines, gasolines, bunker fuel, crude oil, refinery bottoms, crude oil extracts, hazardous wastes, yard trimmings and waste, wood chips and saw dust, fodder, silage, plastics, organic waste, and emulsions, suspensions, and dispersions thereof in water, alcohol, or other carrier fluids, and mixtures of one or more of the foregoing.

24. A method of improving the combustion of and the slag resulting from the combustion of a hydrocarbonaceous fuel composition, the method comprising the steps of:

providing a hydrocarbonaceous fuel composition comprising a transition metal-containing compound, at least one alkali metal compound, and a magnesium-containing compound;

combusting the fuel composition in a combustion system, wherein the combustion of the fuel composition causes the formation of slag;

wherein the amount of transition metal, alkali metal and magnesium contained in the fuel composition is in an amount effective to improve the combustion of the fuel composition and improve the slag resulting from combustion of the fuel.

25. The method as described in claim 24, wherein the transition metal-containing compound, alkali metal compound, and magnesium-containing compound are included in the additive in a ratio of about one part manganese, one part alkali metal, and three parts magnesium of the respective metals.

26. The method as described in claim 24, wherein the transition metal-containing compound is an organometallic compound.

27. The method as described in claim 26, wherein the organometallic compound is a compound with a stabilizing ligand containing a functional

group selected from the group consisting of alcohols, aldehydes, ketones, esters, anhydrides, sulfonates, phosphonates, chelates, phenates, crown ethers, naphthenates, carboxylic acids, amides, acetyl acetonates and mixtures thereof.

28. The method as described in claim 26, wherein the organometallic compound comprises manganese.

29. The method as described in claim 28, wherein the manganese-containing compound is selected from the following group: cyclopentadienyl manganese tricarbonyl, methylcyclopentadienyl manganese tricarbonyl, dimethylcyclopentadienyl manganese tricarbonyl, trimethylcyclopentadienyl manganese tricarbonyl, tetramethylcyclopentadienyl manganese tricarbonyl, pentamethylcyclopentadienyl manganese tricarbonyl, ethylcyclopentadienyl manganese tricarbonyl, diethylcyclopentadienyl manganese tricarbonyl, propylcyclopentadienyl manganese tricarbonyl, isopropylcyclopentadienyl manganese tricarbonyl, tert-butylcyclopentadienyl manganese tricarbonyl, octylcyclopentadienyl manganese tricarbonyl, dodecylcyclopentadienyl manganese tricarbonyl, ethylmethylcyclopentadienyl manganese tricarbonyl, indenyl manganese tricarbonyl, and the like, including mixtures of two or more such compounds.



30. A method as described in claim 24, wherein the alkali metal compound contains an alkali metal selected from the group consisting of lithium, sodium, potassium and rubidium.

31. A method as described in claim 24, wherein the magnesium-containing compound is selected from the group of compounds derived from sulfonic acids, carboxylic acids, alkylphenols, sulfurized alkylphenols, and organic phosphorus acids and mixtures thereof.

32. A method as described in claim 24, wherein the amount of transition metal-containing compound is an sufficient amount to supply about 0.1 to 40 ppm transition metal to the fuel composition.

33. A method as described in claim 24, wherein the amount of alkali metal is an amount sufficient to supply about 0.1 to 40 ppm alkali metal to the fuel composition.

34. A method as described in claim 24, wherein the amount of magnesium-containing is an amount sufficient to supply about 0.3 to 500 ppm magnesium metal to the fuel composition.

35. A method as described in claim 24, wherein the slag is improved by being more easily removed.

36. A method as described in claim 24, wherein the slag is improved by being less built up.

37. A method as described in claim 24, wherein the slag is improved by being more friable.

38. A hydrocarbonaceous fuel additive comprising:

a manganese-containing compound;

an alkali metal compound; and

a magnesium-containing compound.

39. A fuel additive as described in claim 38, wherein the manganese-containing compound is methylcyclopentadienyl manganese tricarbonyl.

40. A fuel additive as described in claim 1, wherein the amount of magnesium-containing compound is sufficient to supply about 20 to about 60 ppm of magnesium metal to the fuel composition.